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ABSTRACT

An instructor's manual and student activity guide on forging are provided in this set of prevocational education materials which focuses on the vocational area of trade and industry (metalworking). (This set of materials is one of ninety-two prevocational education sets arranged around a cluster of seven vocational offerings: agriculture, home economics, distributive education, health occupations, world of work, trade and industry, and office occupations.) The instructor's guide is organized into the following elements: title of activity, duration of activity (seven to ten periods), activity goals, thirteen instructional objectives, related vocational clusters , and activity implementation (description, materials needed, safety considerations, teacher preparation prior to class, during the class, follow-up activities, answer key to student check point activities, and masters for duplication [e.g., student answer sheet and fact sheet]). The student activity guide provides step-by-step instructions (narrative and illustrations) for completing each instructional objective (e.g., forge a chisel shape on a red hot end of metal stock). At the end of each set of instructions is a student check point (evaluation activity). Six occupational descriptions (e.g, die setter, heavy forger) conclude the document. (JH)

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ED169344

T & I – METALWORKING, FORGING

Kit No. 55

INSTRUCTOR'S MANUAL

Prepared by

Robert J. Lake
Easley Junior High School
Easley, South Carolina 29640

State Department of Education
Office of Vocational Education
Prevocational Education
Columbia, South Carolina 29201

In Cooperation With

Vocational Education Media Center
Clemson University
Clemson, South Carolina 29631

1978

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TITLE OF ACTIVITY

Kit No. 55, T & I — Metalworking, Forging

DURATION

Main Activity: 5 — 7 days
Follow-up Activity: 2 — 3 days

GOALS

The main purpose of this activity is to make students aware of the various occupations concerned with metalworking — one small area in the manufacturing world.

INSTRUCTIONAL OBJECTIVES

Provided a metal rule, the student will be able to measure lengths, read dimensions, and figure materials.

The student will be able to identify five tools used in forging.

The student will become familiar with the parts of and the proper use of a hacksaw.

The student will identify the parts of a file and proper use of the file.

The student will identify the parts of a vise and will learn how to use the vise.

After obtaining a piece of metal stock from the instructor, a student will measure and mark a 5 inch (12.7 cm) length of stock.

Using a hacksaw, each student will cut off 5 inches (12.7 cm) of octagonal metal stock.

Using a file, the student will clean any burrs or rough edges off the metal.

The metal stock will be heated to a proper temperature for forging.

Each student will forge a chisel shape on the red hot end of the metal stock.

Given the proper tools, each student will file the forged shape until it is smooth.

Given the proper tools and equipment, students will form the tip of the chisel.

Given the proper tools and equipment, each student will temper (heat treating the metal) the tip of the chisel.

VOCATIONAL CLUSTERS

Agriculture

ACTIVITY IMPLEMENTATION

A. Description

This activity will demonstrate some of the skills and jobs related to the metalworking industry. It will focus on the forging and heat treating areas of metalworking. In this activity you will manufacture a cold chisel by a hand method of forging. This method of metal forming dates back to very early civilizations. It is a process which is still used in today's highly technological industries.

B. Safety

Working with any metal is dangerous. Sharp edges and metal filings can be potential hazards. Be sure that students know hot metal may not look hot. When metal cools slightly it may look normal but can still be very hot to touch.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.

SAFETY NOTE: Wear safety goggles and leather gloves while working with hot metal.

C. Materials

1. Audio Visual Equipment:
   None

2. Technical Equipment

   6 metal rulers, 18 inch (45.72 cm)
   6 propane wire stands and screw-on nozzles (no tanks)
   6 small anvils
   6 ball peen hammers
   6 metal files
   6 file cards
   6 vise grips
   6 c-clamps
   6 vises, 3½ inch (8.89 cm)
   2 hacksaws

3. Expendable Supplies

   12 propane or mapp gas containers
   130 inches (3.3 meters) of octagonal metal stock
   1 can of cool water

D. **Preparation Prior to Class**

Locate work stations in the classroom for the various working areas for this activity. One area for cutting stock should be free of any objects except a table and vises. A second area for heat treatment and forming should have the propane gas and anvils placed close together.

The cutting area should not be next to the heating area. Read the student activity guide prior to the class session. Locate and secure all material prior to class use.

E. **During Class Sessions**

Distribute all printed material. Explain to the students that safety is of prime importance because of the methods and materials utilized in this activity.

Position yourself between the cutting area and the heat treatment area. This vantage point should enable you to view any activities which require use of hand tools and heat. Examine each student's work carefully. Look for a smooth, filed surface on both sides of the chisel. The tip should be filed to a sharp point; inspect this carefully. Help all students with the tempering of their chisel tips. This is a very critical point in the activity which requires your close supervision.

F. **Follow-up Activities**

1. VIEW Fact Sheet
2. Have each student identify jobs in want ads or pictures of people employed in heat treating or metalworking in a newspaper or magazine.
3. Identify or list items around the shop, home, and school which were formed by this process.

ANSWER KEY

Objective No. 1

1. E
2. C
3. A
4. B
5. D

Objective No. 2

1. E
2. A
3. B
4. D
5. C

Objective No. 3

1. C
2. D
3. A
4. B

Objective No. 4

1. C
2. B
3. D
4. E
5. A

Objective No. 5

A. Handle
B. Jaws
C. Body
D. Clamp

MASTERS FOR DUPLICATION

1. VIEW Fact Sheet
2. Answer Sheet

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
1.
2.
3.

D. What type of education should you get to be prepared (do) for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

I. To learn more about this occupation (job), write to:

J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

I don't like it. 1 2 3 4 5 I like it.

STUDENT ANSWER SHEET

INSTRUCTIONAL OBJECTIVE I

1. _____
2. _____
3. _____
4. _____
5. _____

INSTRUCTIONAL OBJECTIVE II

1. _____
2. _____
3. _____
4. _____
5. _____

INSTRUCTIONAL OBJECTIVE III

1. _____
2. _____
3. _____
4. _____

INSTRUCTIONAL OBJECTIVE IV

1. _____
2. _____
3. _____
4. _____
5. _____

INSTRUCTIONAL OBJECTIVE V

A. _____
B. _____
C. _____
D. _____

T & I – METALWORKING, FORGING

Kit No. 55

STUDENT

LEARNING ACTIVITY GUIDE

Prepared by

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T & I – METALWORKING, FORGING

INTRODUCTION

This activity will demonstrate some of the skills and jobs related to the metalworking industry. It will focus on the forging and heat treating areas of metalworking. In this activity you will manufacture a cold chisel by a hand method of forging. This method of metal forming dates back to very early civilizations. It is a process which is still used in today's highly technological industries.

GOALS

The main purpose of this activity is to make students aware of the various occupations concerned with metalworking – one small area in the manufacturing world.

DIRECTIONS

Care should be taken in the use of this text. All written work will be turned in on a separate sheet of paper. Read each objective and step carefully; do not proceed to any objective until each checkpoint has been successfully accomplished.

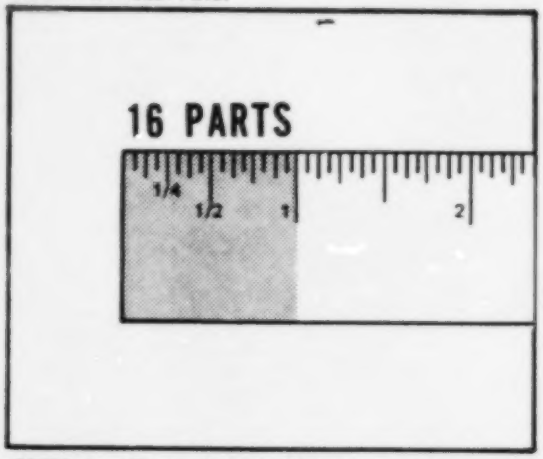
MATERIALS

Octagonal metal stock
Vise
Hacksaw
File
Metal ruler [18 inches (.45 m)]
C-clamps
Vise grips
Propane or mapp gas
Can of cold water
Anvil

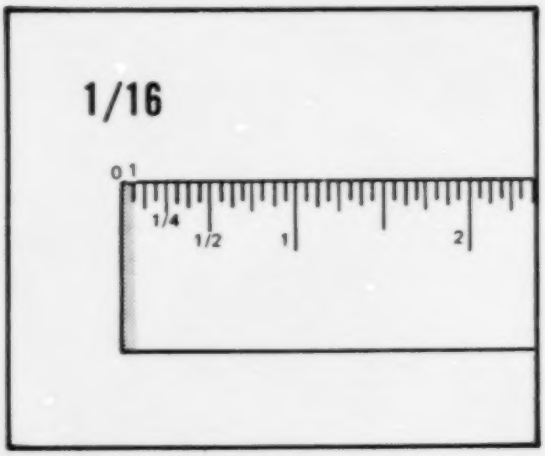
PROGRAMMED TEXT

Instructional Objective 1

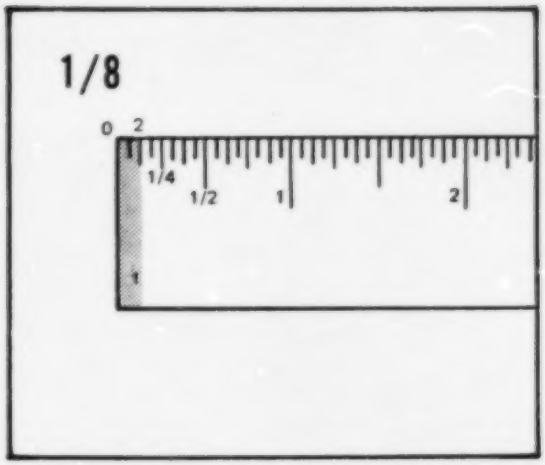
Being able to measure accurately is essential in doing metal work. A person working with metal must be able to measure lengths, read dimensions, and figure materials. Obtain a metal rule.



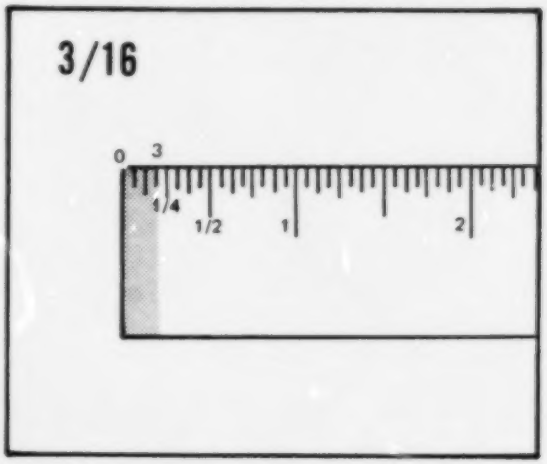
STEP 1 – To understand how to measure, you must understand the sixteen parts of an inch. This shows an inch broken down into 16 equal parts.



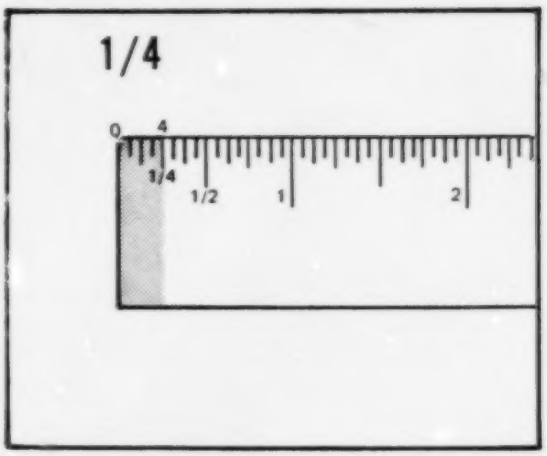
STEP 2 – From 0 to the mark labeled 1 is 1/16 inch.



STEP 3 – From 0 to the mark labeled 2 is 2/16 or 1/8 inch; we will call it 1/8 inch.

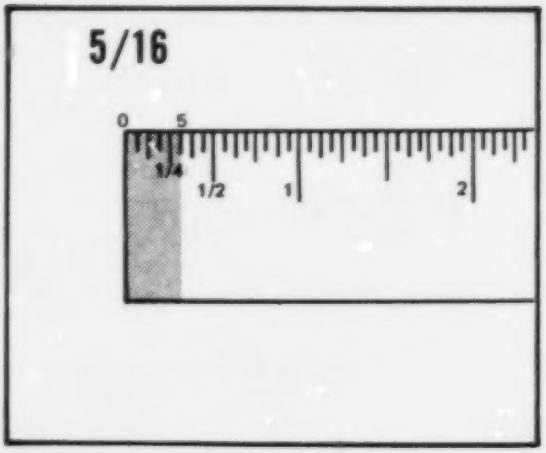


STEP 4 – From 0 to the mark labeled 3 is 3/16 inch.

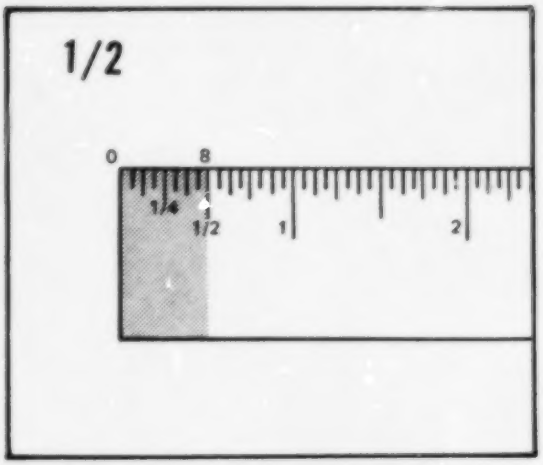


STEP 5 – From 0 to the mark labeled 4 is 4/16 inch or ¼ inch; we will call it ¼ inch.

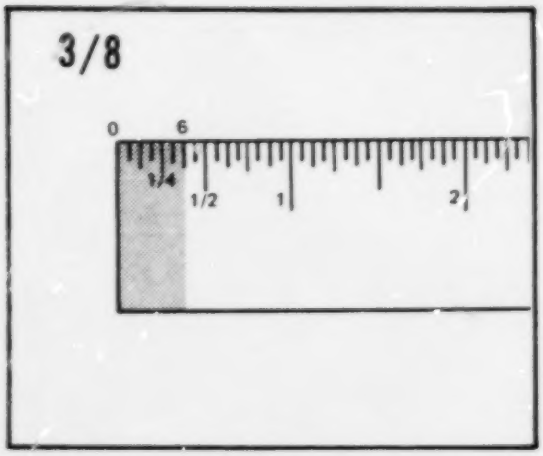
10



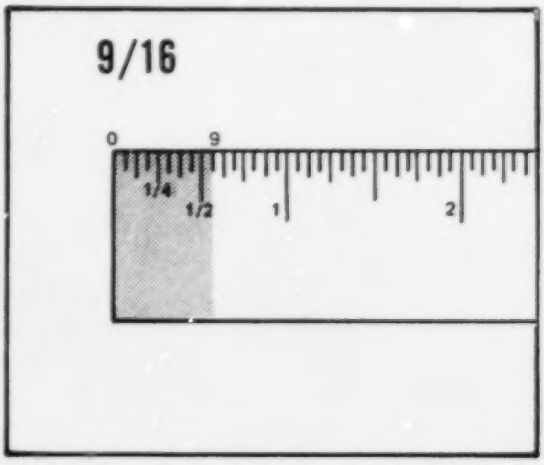
STEP 6 – From 0 to the mark labeled 5 is 5/16 inch.



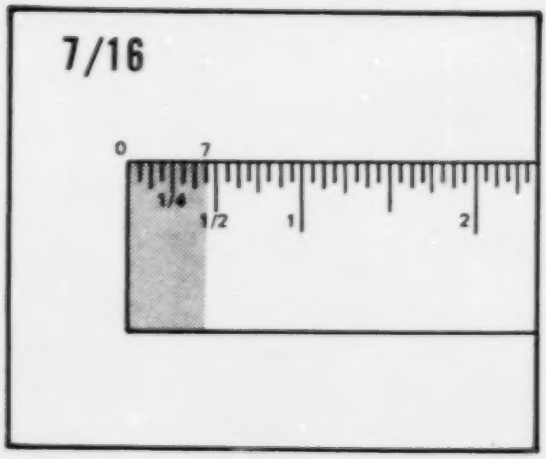
STEP 9 – From 0 to the mark labeled 8 is 8/16 inch, or ½ inch; we will call it ½ inch.



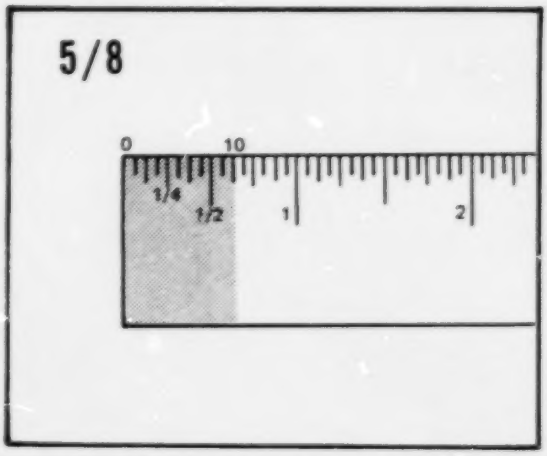
STEP 7 – From 0 to the mark labeled 6 is 6/16 or 3/8 inch; we will call it 3/8 inch.



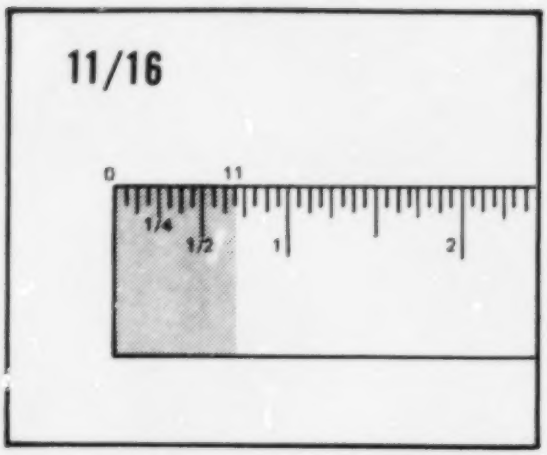
STEP 10 – From 0 to the mark labeled 9 is 9/16 inch.



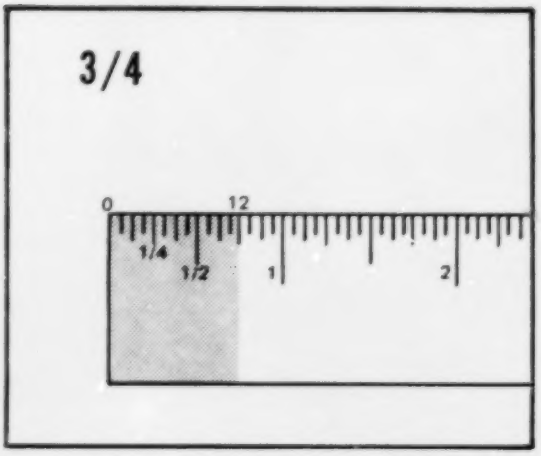
STEP 8 – From 0 to the mark labeled 7 is 7/16 inch.



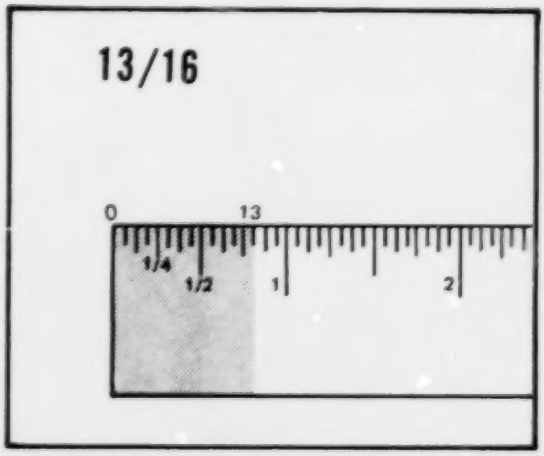
STEP 11 – From 0 to the mark labeled 10 is 10/16 inch or 5/8 inch; we will call it 5/8 inch.



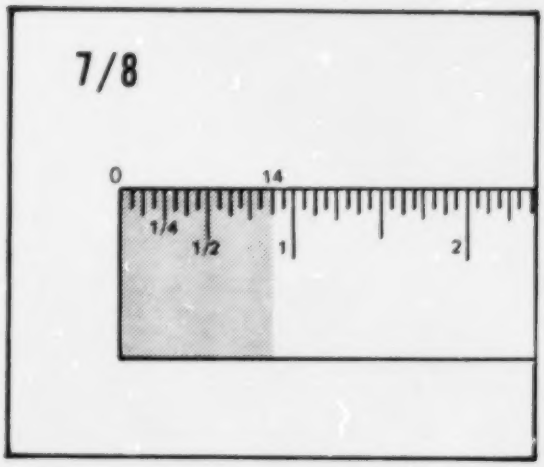
STEP 12 – From 0 to the mark labeled 11 is 11/16 inch.



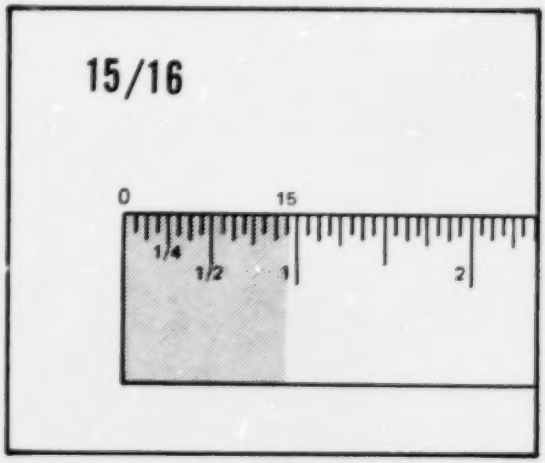
STEP 13 – From 0 to the mark labeled 12 is 12/16 or ¾ inch; we will call it ¾ inch.



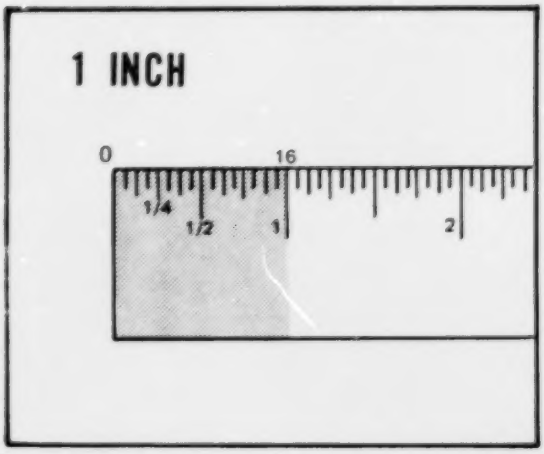
STEP 14 – From 0 to the mark labeled 13 is 13/16 inch.



STEP 15 – From 0 to the mark labeled 14 is 14/16 or 7/8 inch; we will call it 7/8 inch.



STEP 16 – From 0 to the mark labeled 15 is 15/16 inch.



STEP 17 – From 0 to the mark labeled 16 is 16/16 or 1 inch.

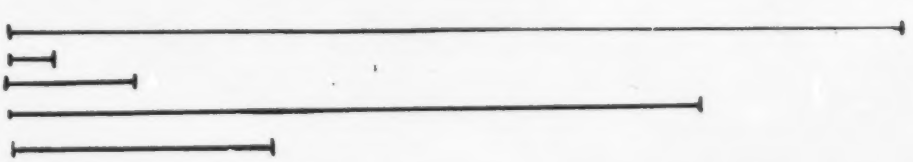
12

STEP 18 – Look at the first inch on the metal rule.

Check Point

Using the metal rule and Student Answer Sheet, measure the lines to the right of the letters A, B, C, D, ... Select the correct measurement and place the letter in the space to the right on Student Answer Sheet for Instructional Objective I.

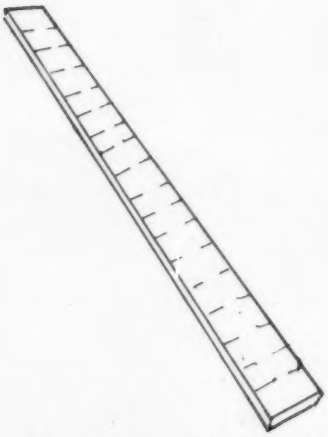
A	¾"	1
B.	4"	2
C.	¼"	3
D.	1½"	4
E.	5 1/8"	5



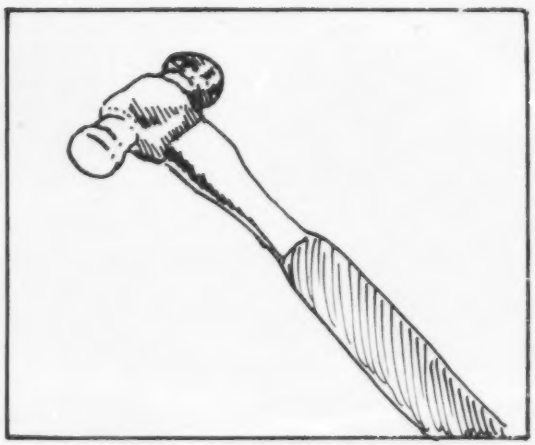
STEP 19: Check your answers.
1 – E, 2 – C, 3 – A, 4 – B, 5 – D

Instructional Objective II

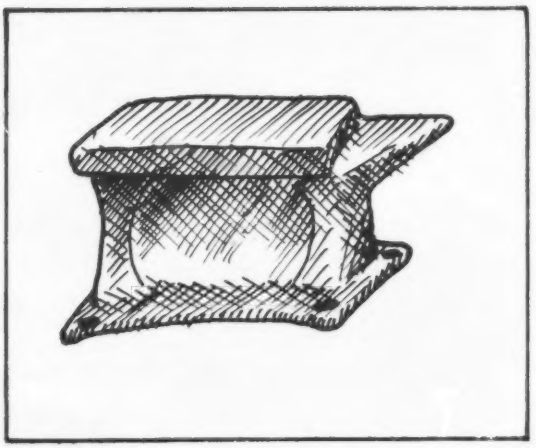
The student will be able to identify five tools used in forging.



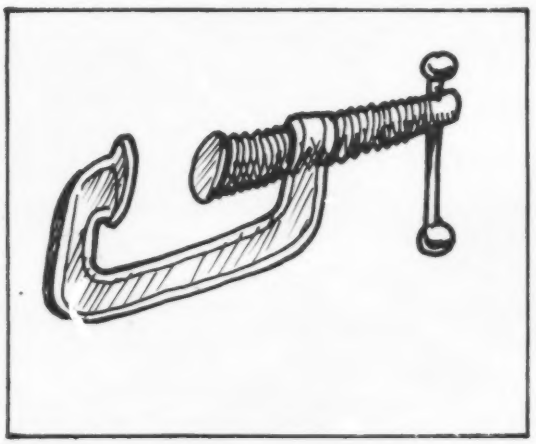
STEP 1 – The metal rule is 18 inches (45.72 cm) long and can be used as a straight edge for drawing lines.



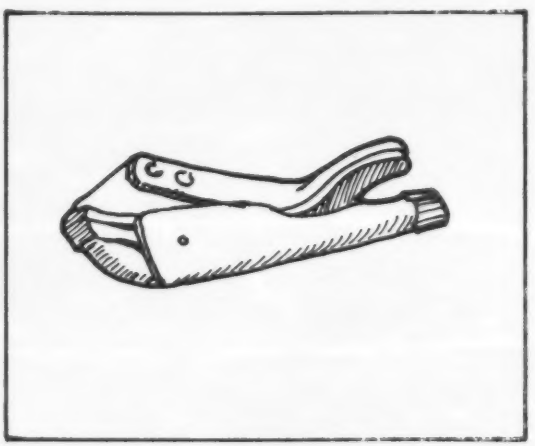
STEP 2 – The ball peen hammer is used to strike (hit) many of the metalworking tools.



STEP 3 – An anvil is used to forge (form heated metal) material into different shapes.



STEP 4 – A c-clamp will be used to secure the anvil to a tabletop for safe use.

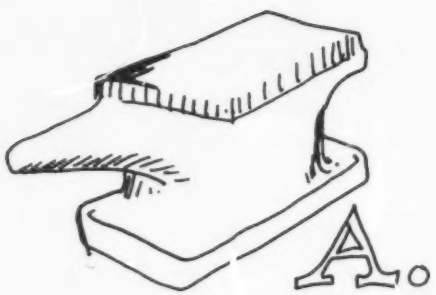


STEP 5 – Vise grips are used to hold metal in a stationary position.

Check Point

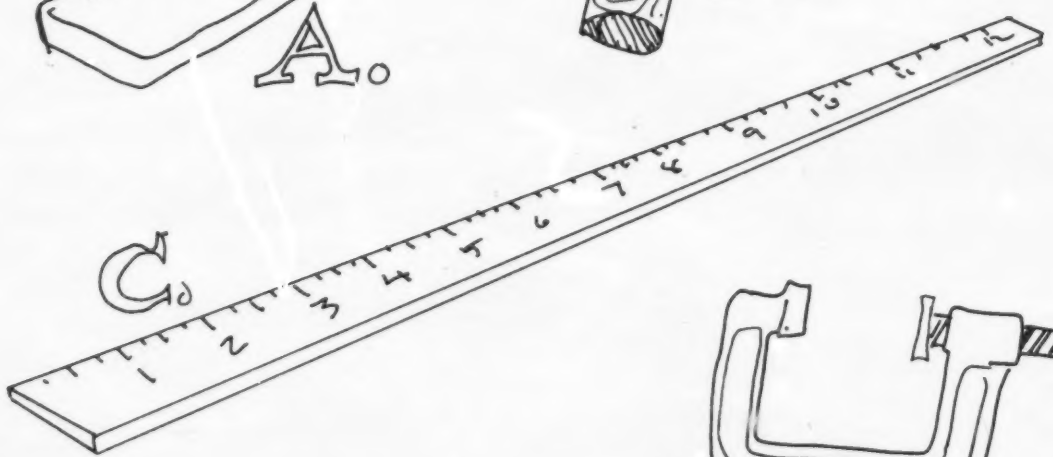
Match the following tools with their names by placing the correct letter in the blank on your answer sheet for Instructional Objective II.

1. Ball peen hammer
2. Anvil
3. C-clamp
4. Vise grips
5. Metal rule

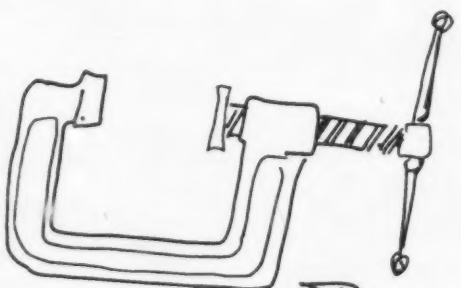


A.

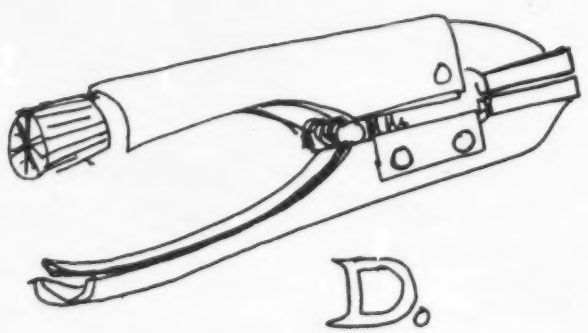
E.



C.



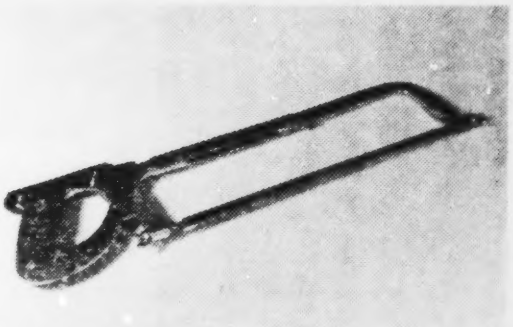
B.



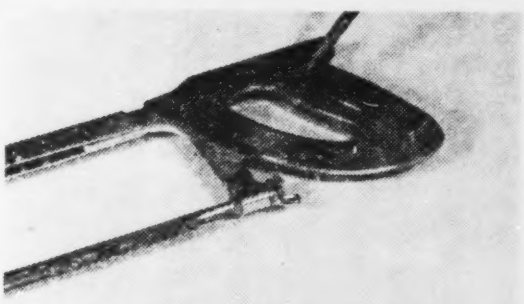
D.

Instructional Objective III

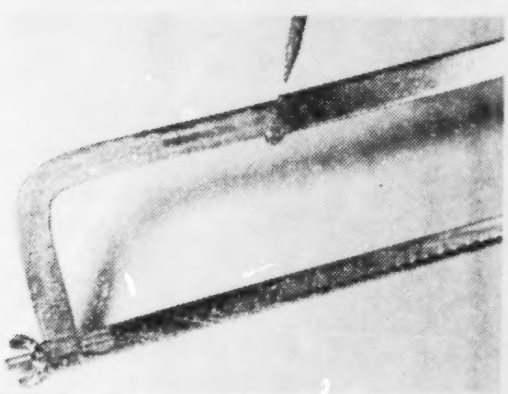
The student will become familiar with the parts of and the proper use of a hack saw.



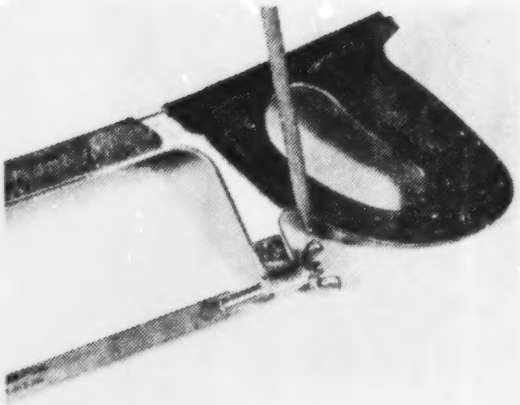
STEP 1 – The hacksaw has four major parts: The handle, frame, tension adjustment and the blade.



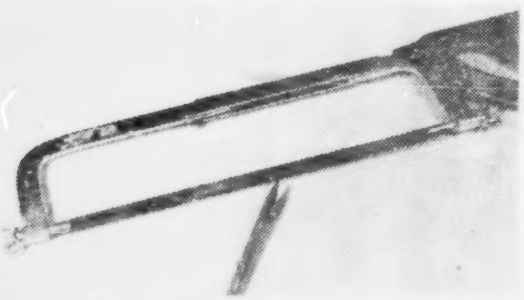
STEP 2 – The handle is shaped like a pistol grip to fit easily in the hand and make it more comfortable to use.



STEP 3 – The frame is shaped similar to the letter "U." IT IS ADJUSTABLE AND CAN BE SET TO FIT BLADES OF VARIOUS LENGTHS.



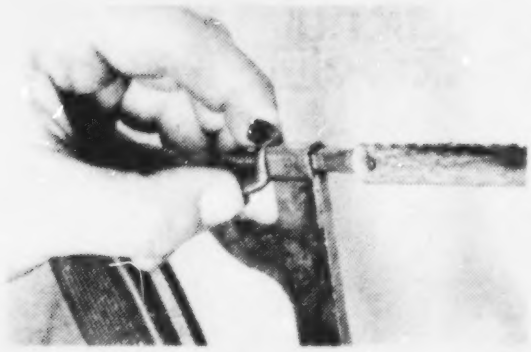
STEP 4 – The tension adjusting unit consists of wing nut and a sliding bolt. Its purpose is to apply tension on the blade.



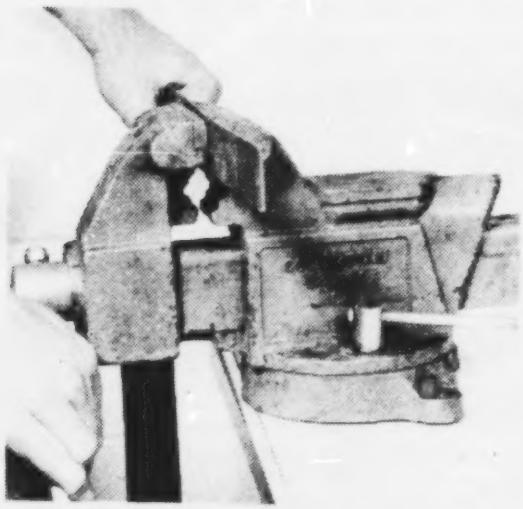
STEP 5 – The blade is ½ inch wide (1.27 cm) and it is .025 inches thick. The length can be either 8 inches (20.32 cm), 10 inches (25.4 cm), 12 inches(30.48 cm). The steel in a metal cutting saw blade must be harder than the metal to be cut, therefore, these blades are made of hardened steel. The size of teeth varies according to the number of teeth per inch.

STEP 6 – Pick the saw up and check to see that the blade is inserted correctly.

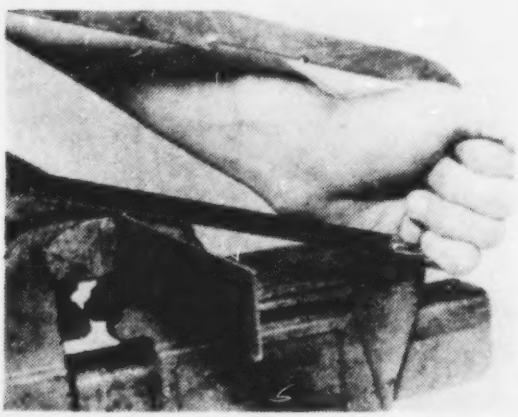
16



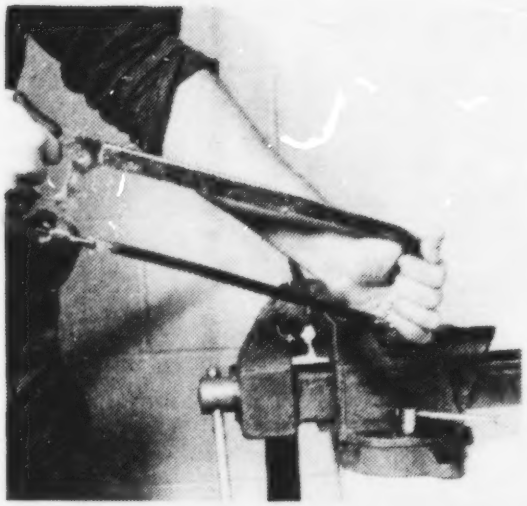
STEP 7 – Check the blade tension and adjust it, if needed, by turning the wing nut on the blade tension adjustment.



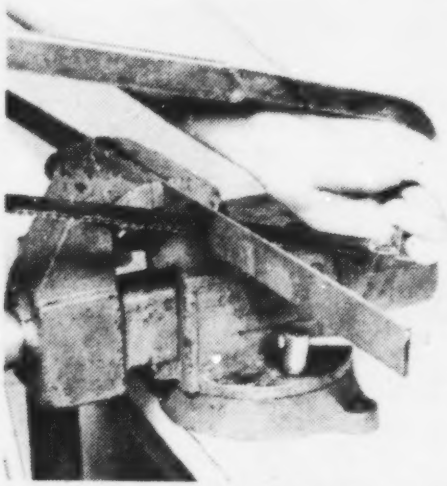
STEP 8 – The metal to be cut should be put in a vise.



STEP 9 – To start a cut, the blade should be placed on the metal with as many teeth as possible touching the metal.



STEP 10 – Stand in a relaxed position at the vise and hold the saw correctly.



STEP 11 – Put the saw blade down against the metal. Push the saw forward and apply just enough pressure to cause the blade to cut the metal.

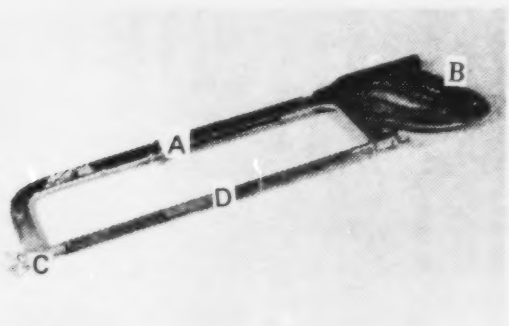
STEP 12 – Continue sawing with a light pressure until the cut is started. Do not use a rapid, jerky sawing motion; use a smooth back-and-forth motion, with a full stroke of the blade.

STEP 13 – Use less pressure on the saw when the cut is almost through the metal.

Check Point

Match the parts of the hack saw with the correct name by placing the letter in the blank on your answer sheet for Instructional Objective III.

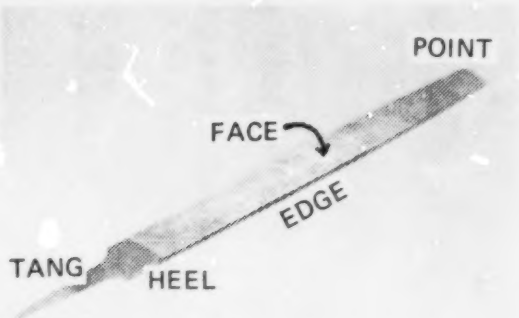
1. Tension adjustment
2. Blade
3. Frame
4. Handle



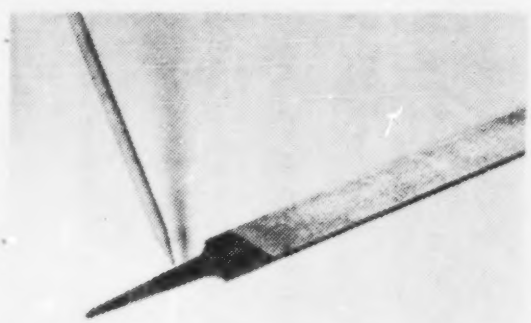
STEP 14 – To check your answers: 1 - C, 2 - D, 3 - A, 4 - B.

Instructional Objective IV

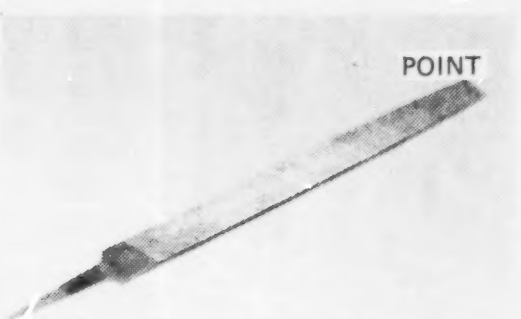
The student will identify the parts of a file and proper use of the file.



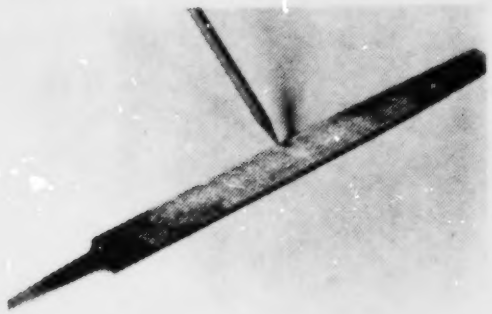
STEP 1 – There are five parts of a file: the point, face, edge, heel, and tang.



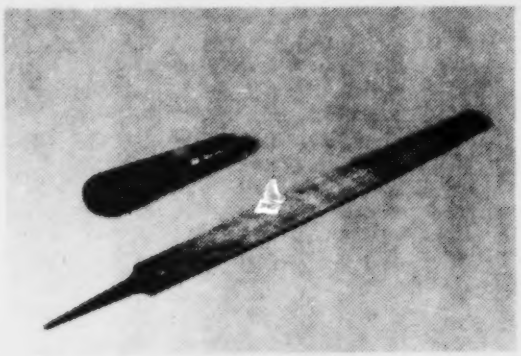
STEP 2 – The tang is the narrow end of a file where the handle is fastened.



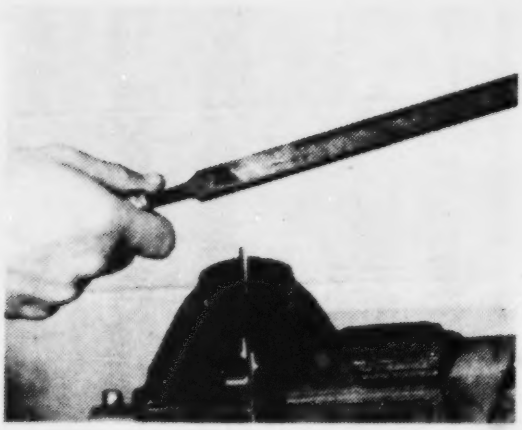
STEP 3 – The size of a file is the length measured from the end of the point to the end of the tang.



STEP 4 – The teeth of the file are made of hardened steel because they must be harder than the metal being filed. The teeth do the cutting.

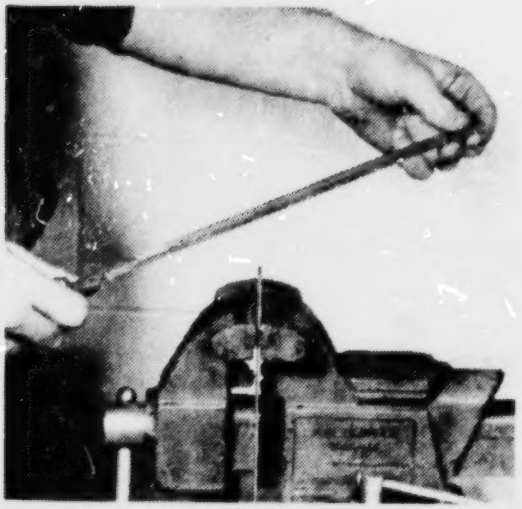


STEP 5 – A wooden handle fits on the tang and is tightened by tapping it on a table or floor.

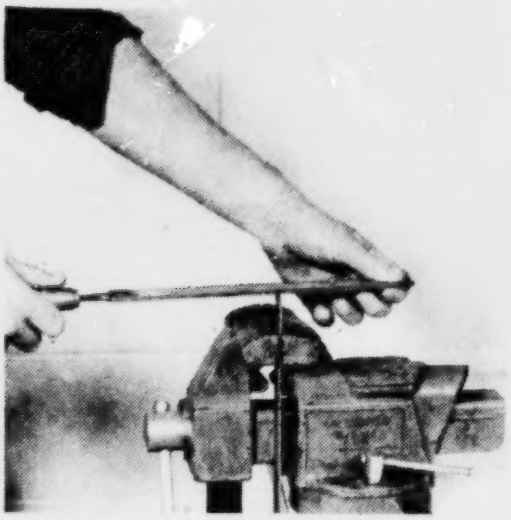


STEP 6 – Hold the handle in either the right or left hand according to which you favor.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.



STEP 7 – Grab the point with the thumb and first two fingers of the other hand.

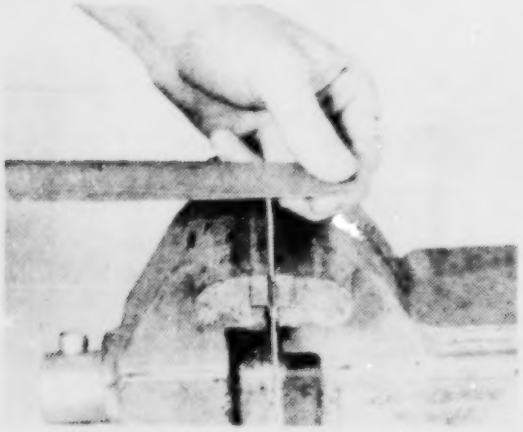


STEP 8 – Stand in a relaxed position.

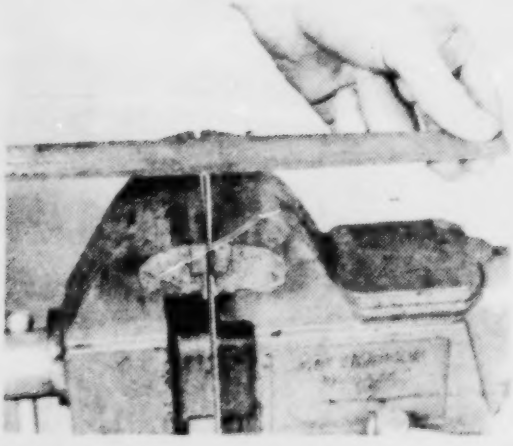
STEP 9 – Place the file flat on the metal with the teeth pointing to the front.

19

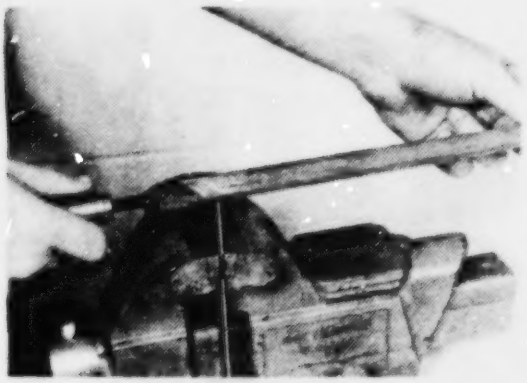
STEP 10 – Keep the file level and push it across the metal.



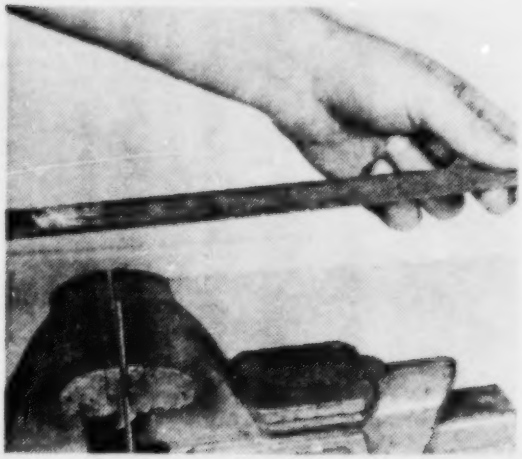
STEP 11 – Apply more pressure with the hand in front at the start of the stroke.



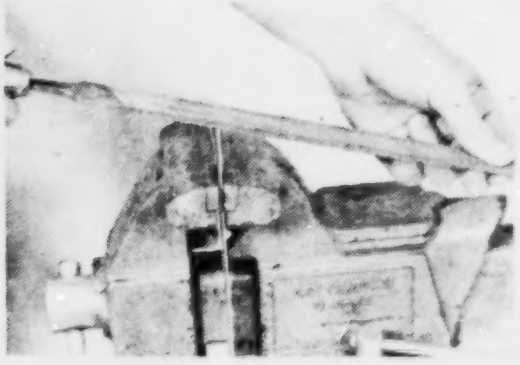
STEP 12 – Release some of the pressure of the front hand when the file reaches the center.



STEP 13 – Apply more pressure with the back hand for the rest of the stroke.

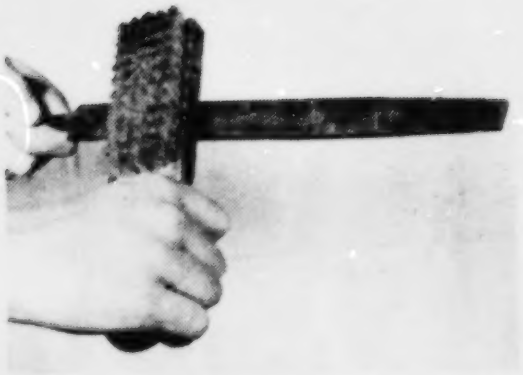


STEP 14 – The file cuts only in one direction on the forward stroke. It should be lifted on the return stroke.



STEP 15 – Keep the file from rocking on the metal; this is the most common error.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.

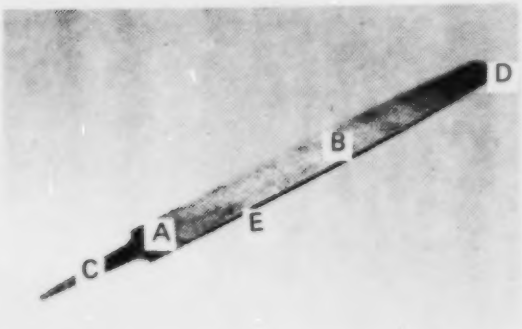


STEP 16 – Cleaning a file is done with a file card.

Check Point

Match the parts of a file with the correct name by placing the letter in the blank on the answer sheet for Instructional Objective IV.

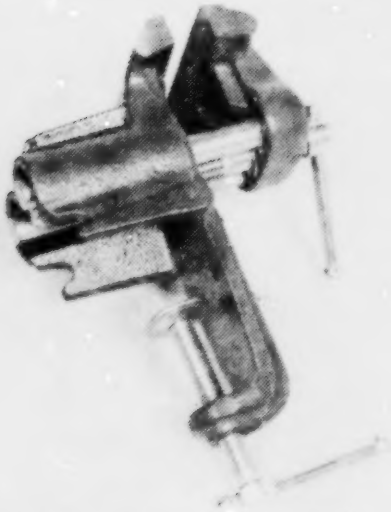
1 – Tang
2 – Face
3 – Point
4 – Edge
5 – Heel



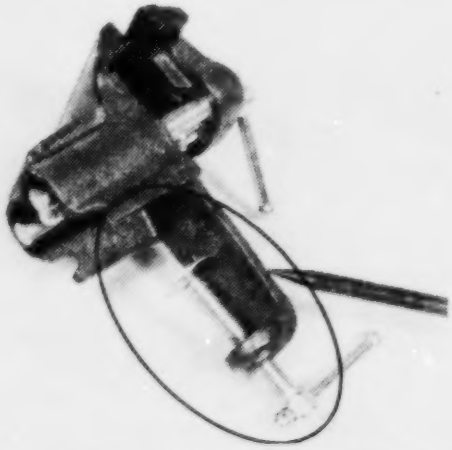
STEP 17 – To check your answers: 1 - C, 2 - B, 3 - D, 4 - E, 5 - A.

Instructional Objective V

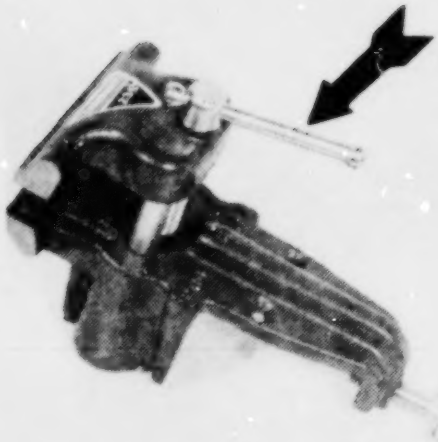
The student will identify the parts of a vise and will learn how to use the vise.



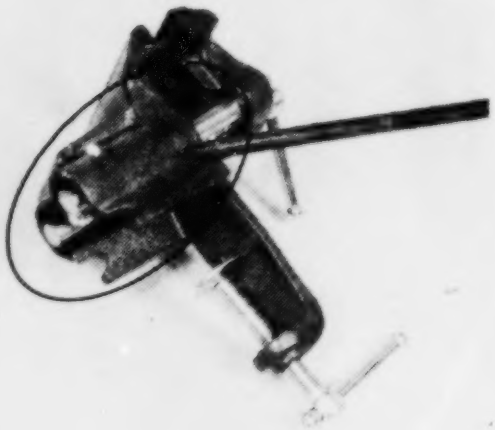
STEP 1 – There are four basic parts to a vise, the handle, table clamp, jaws, and body.



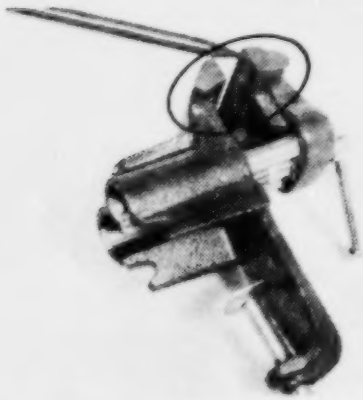
STEP 2 – The table clamp is adjustable so that it will fit different tables. The adjustment has a bolt going through it which, when run in, tightens on the table.



STEP 3 – The handle is on the end of a big bolt which tightens or loosens the vise.



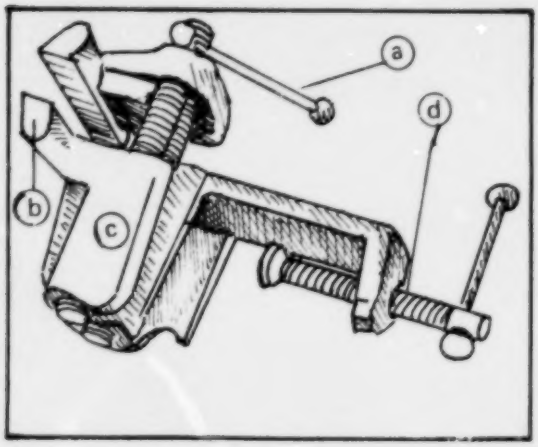
STEP 4 – The body is the largest part of the vise; it gives the vise strength.



STEP 5 – The jaws are what clamp the metals in place.

Check Point

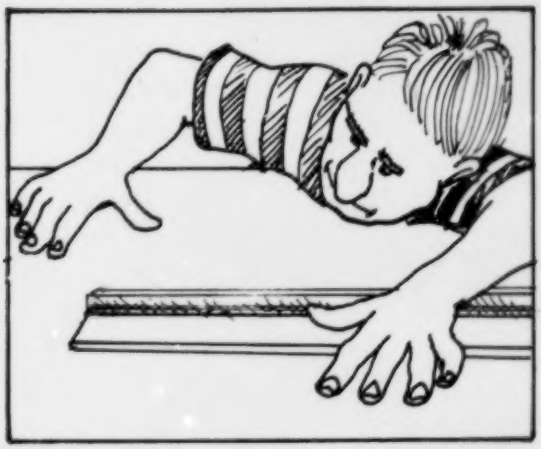
Using the answer sheet for Objective V identify the parts of the vise.



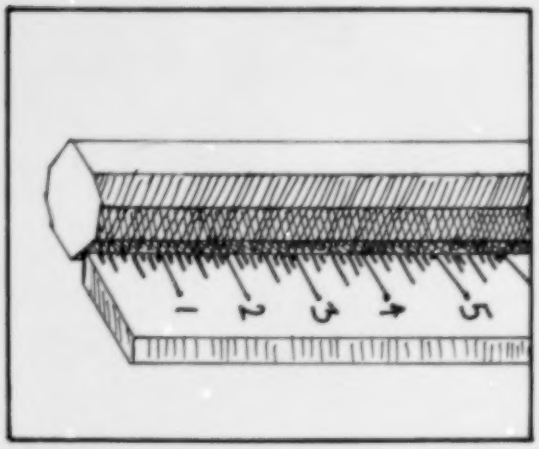
Instructional Objective VI

After obtaining a piece of metal stock from the instructor, a student will measure and mark a 5 inch (12.7 cm) length of stock.

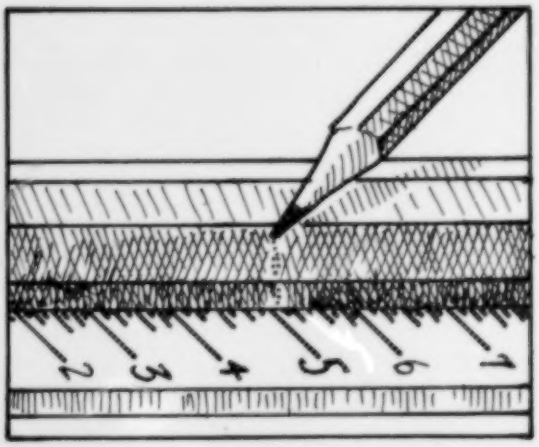
STEP 1 – Go to the instructor and obtain a piece of octagonal metal stock.



STEP 2 – Place one end of the metal beside the zero end of the metal ruler.



STEP 3 – Locate the large number five (5) on the metal ruler.



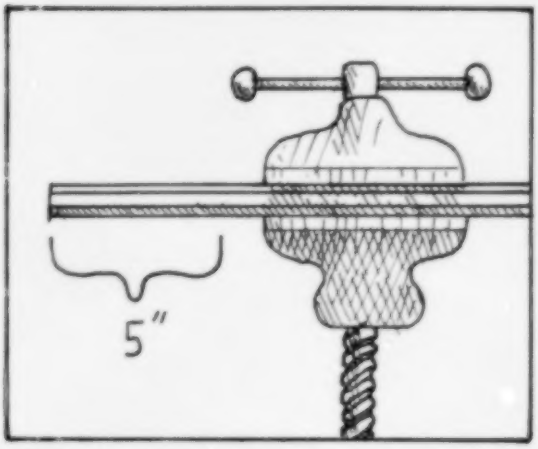
STEP 4 – With a pencil, mark this point.

Check Point

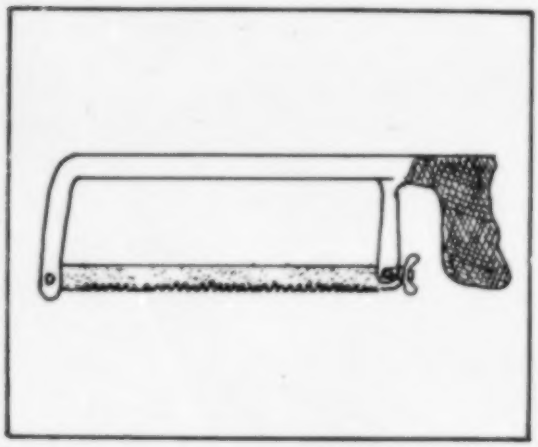
Have a fellow student check the accuracy of your measurement.

Instructional Objective VII

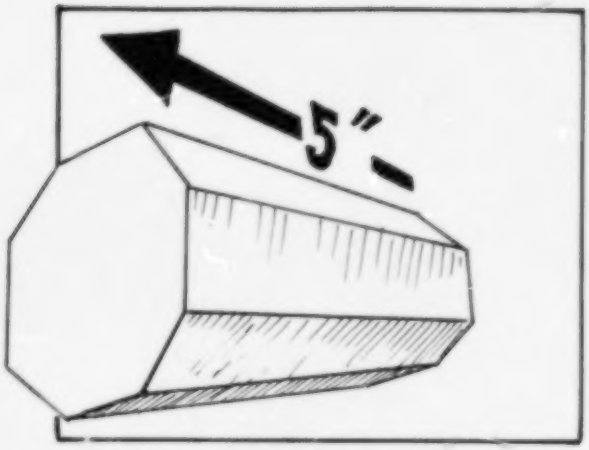
Using a hacksaw, each student will cut off 5 inches (12.7 cm) of octagonal metal stock.



STEP 1 – Place the metal in a vise. Be sure the 5 inch (12.7 cm) mark measured in objective 6 extends at least 1/2 inch (1.27 cm) beyond the end of the vise.



STEP 2 – Carefully pick up a hacksaw. See objective 3 for proper adjustments and use.



STEP 3 – Cut off the 5 inch (12.7 cm) piece of metal with the hacksaw by using long, even strokes.

STEP 4 – Return the hacksaw and remove the metal stock from the vise.

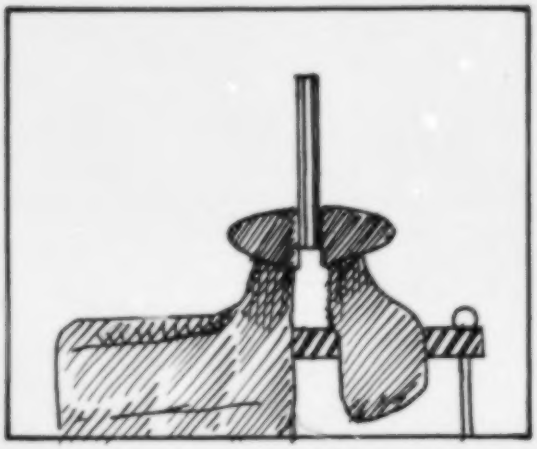
Check Point

Have you returned all material to its proper place?

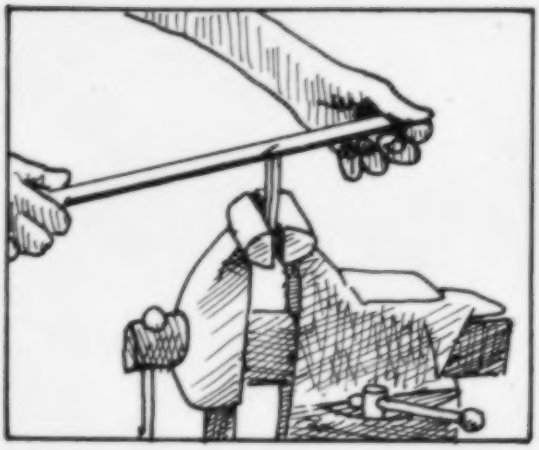
Keep the 5 inch (12.7 cm) piece of metal for objective 8.

Instructional Objective VIII

Using a file, the student will clean any burrs or rough edges off the metal.

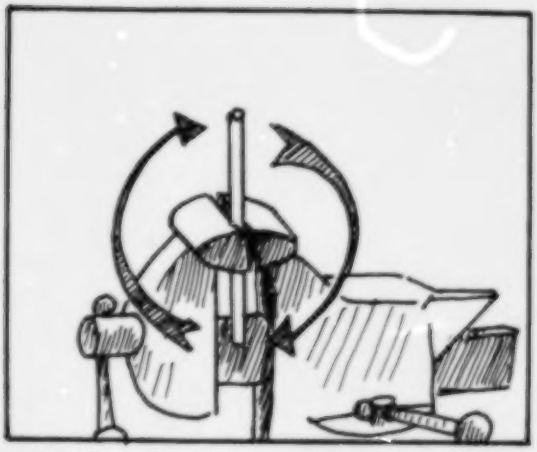


STEP 1 – Place the 5 inch (12.7 cm) piece of metal vertically (↕) in a vise. Allow approximately 1 – 2 inches (2.54 – 5.08 cm) of the metal to extend above the jaws of the vise.

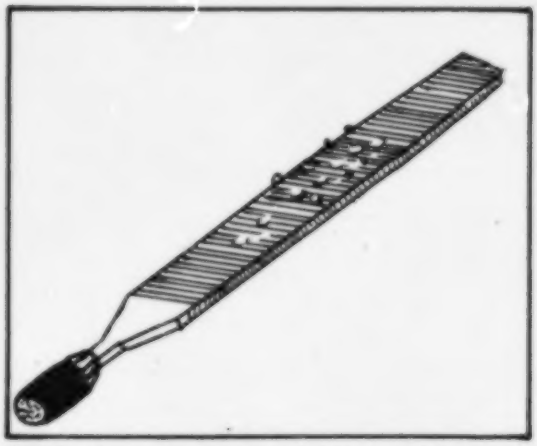


STEP 2 – Using the metal file, smooth the end of the metal stock. Follow the procedure explained in objective 4.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.



STEP 3 – When the end is smooth, position the metal stock so that the other end can be filed.



STEP 4 – Upon completion of filing both ends of the metal stock, check the file to see if it needs cleaning.

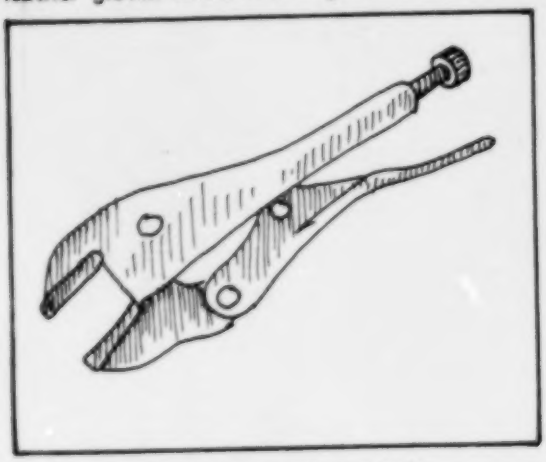
Check Point

Ask a fellow student if the ends of the metal are smooth.

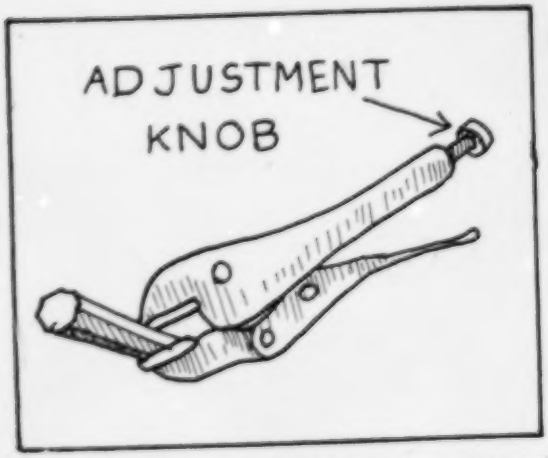
Instructional Objective IX

Given the proper tools and equipment, the metal stock will be heated to a proper temperature for forging.

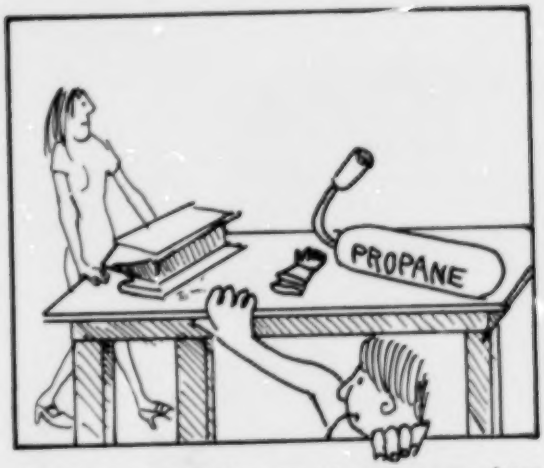
SAFETY NOTE: Wear safety goggles and leather gloves while working with hot metal.



STEP 1 – Obtain a vise-grip wrench.

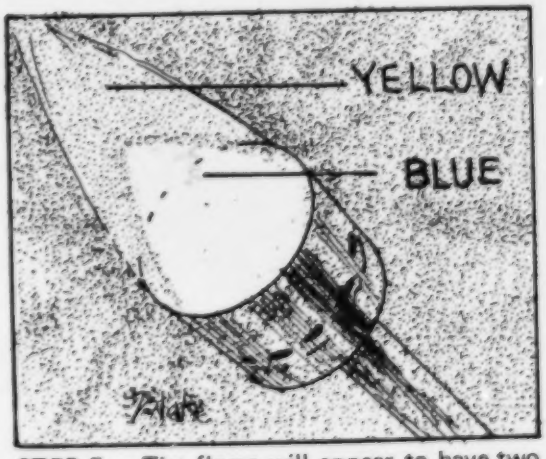


STEP 2 – By adjusting the knob and band levers of the vise grip, secure one end of the metal stock.

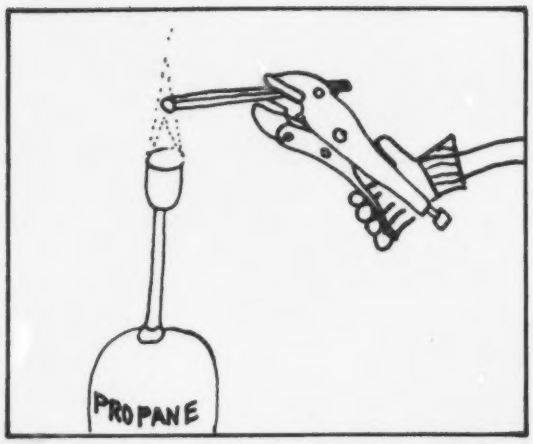


STEP 3 – Go to the area of your room where the anvils and propane gas tanks are located.

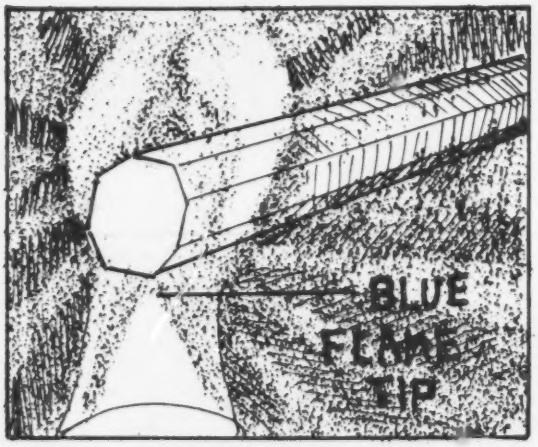
STEP 4 – Ask the instructor to ignite the propane gas.



STEP 5 – The flame will appear to have two colors; one will be a yellow flame, the other a blue flame.



STEP 6 – Holding the metal with vise grips, place the end of the metal opposite your hand on the tip of the blue flame.



STEP 7 – Hold the metal on the tip of the blue flame until the metal turns a bright cherry color of red. The metal is now at the correct temperature to be forged.

SAFETY NOTE: Wear safety goggles and leather gloves while working with hot metal.

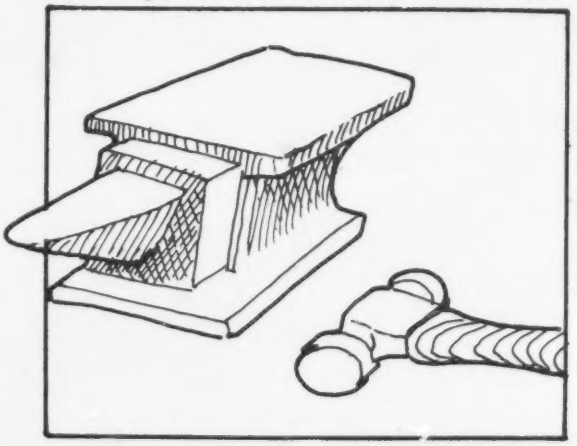
Check Point

Do not overheat the metal. If the metal rod begins to melt, raise it into the yellow flame, but do not let the cherry red color disappear.

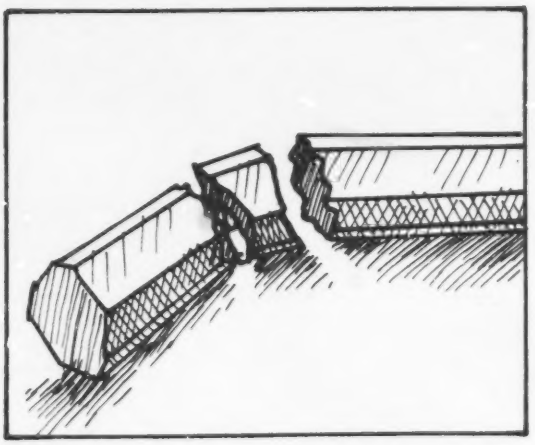
Instructional Objective X

Each student will forge a chisel shape on the red hot end of the metal stock.

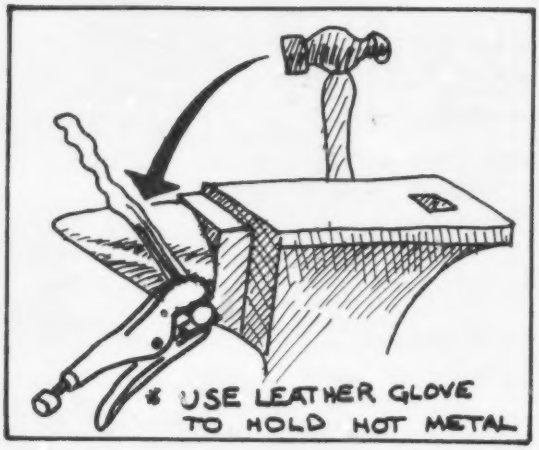
SAFETY NOTE: Wear safety goggles and leather gloves while working with hot metal.



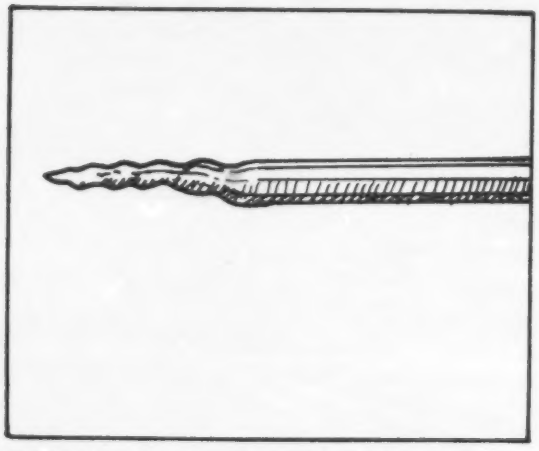
STEP 1 – Two tools used in forging are the anvil and hammer. The hammer is used to strike the metal to flatten or draw it out against the anvil.



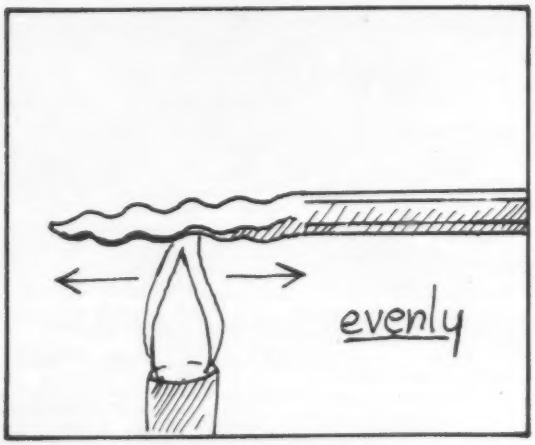
STEP 2 – All metal must be forged while red hot or hotter. If hammered at a lower temperature, it will crack or split.



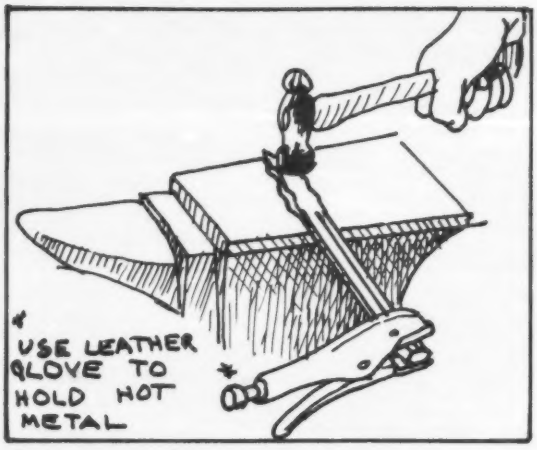
STEP 3 – To draw or stretch the metal quickly, place it on the horn of the anvil.



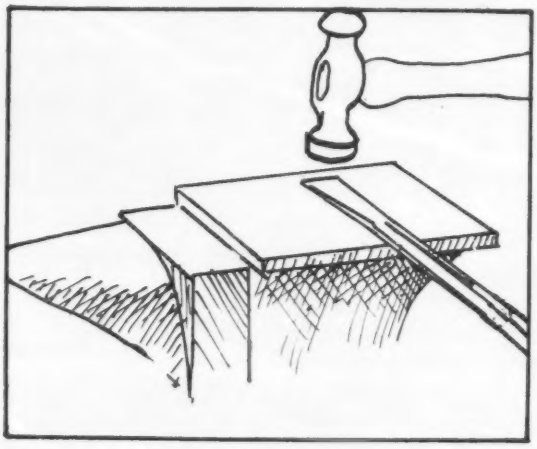
STEP 4 – Strike the metal with a hammer. Hammer it until five notches appear; this will lengthen but not widen the rod.



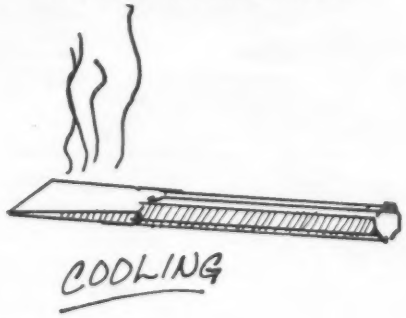
STEP 5 – Do not let the metal get cool. Place it over the heat again, if needed.



STEP 6 – To forge the chisel shape, place the notched end of metal on the flat face of the anvil.



STEP 7 – Quickly hammer the metal until the surface becomes semi-smooth.



STEP 8 – Do not place the hot metal under water to cool it. Allow the metal to cool at its own speed.

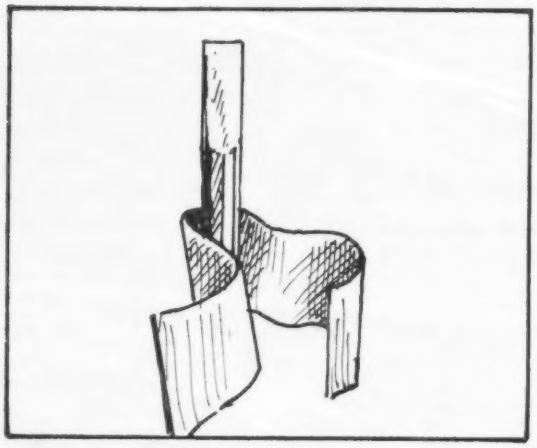
Check Point

Ask the instructor to inspect the cool piece of metal for proper shape.

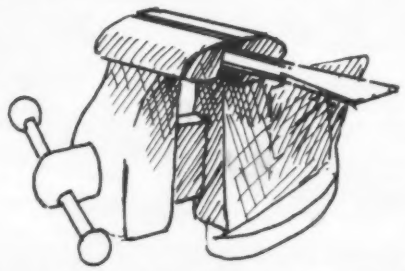
28

Instructional Objective XI

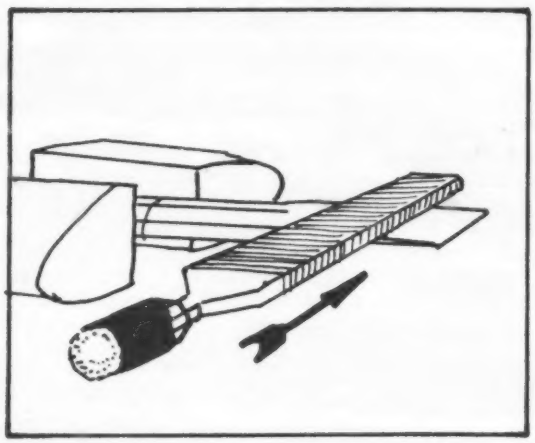
Given the proper tools, each student will file the forged shape until smooth.



STEP 1 – Wrap paper around the chisel handle.

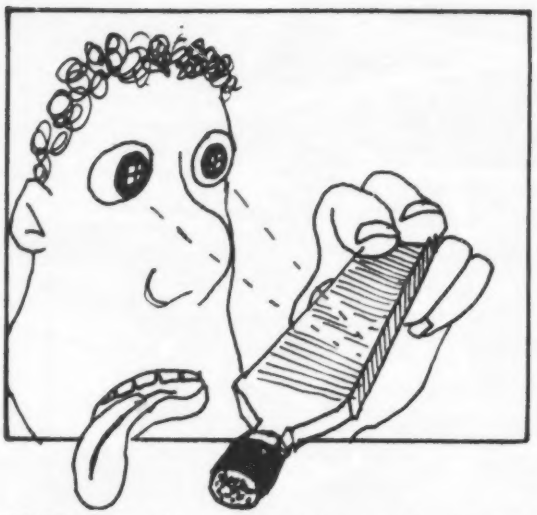


STEP 2 – Tighten this end in the vise horizontally. Allow the forged shape to extend over one end.

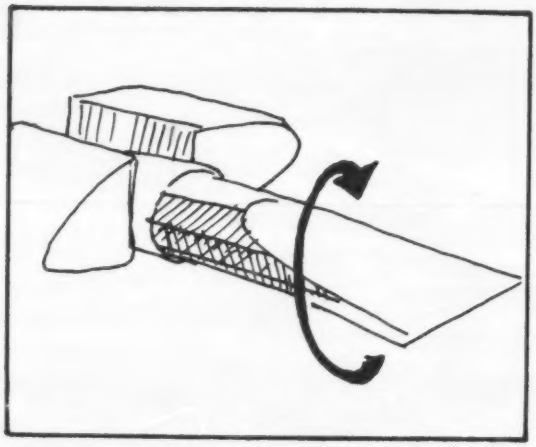


STEP 3 – Smooth the forged shape by filing.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.



STEP 4 – Check the file periodically for loading (excess metal buildup) and clean it with a file card.



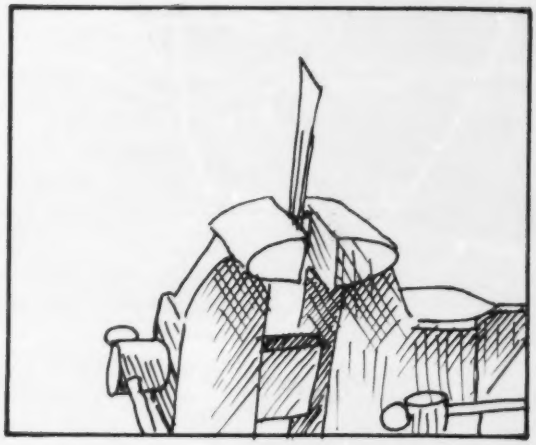
STEP 5 – Repeat steps 1 – 4 to smooth the other side of the metal.

Check Point

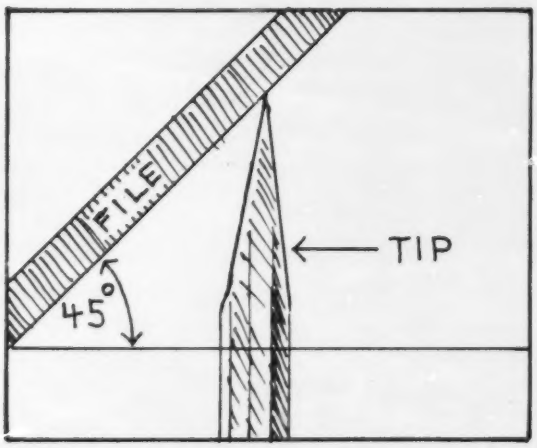
Are both sides filed evenly?

Instructional Objective XII

Given the proper tools and equipment, students will form the tip of the chisel.

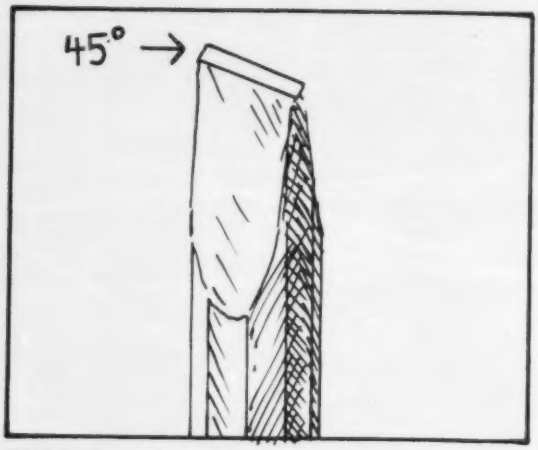


STEP 1 – Place the paper-wrapped end of the chisel vertically in a vise.

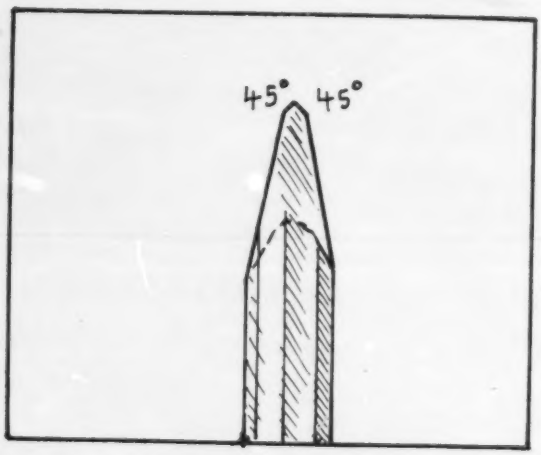


STEP 2 – Use a file and shape the tip of the chisel into a point. Slant the angle of the file to approximately 45 degrees.

SAFETY NOTE: To avoid injury always use the file with the handle tightly secured to the tang.



STEP 3 – After one side of the tip has been filed, switch the position of the metal in the vise so that the other side can be filed.



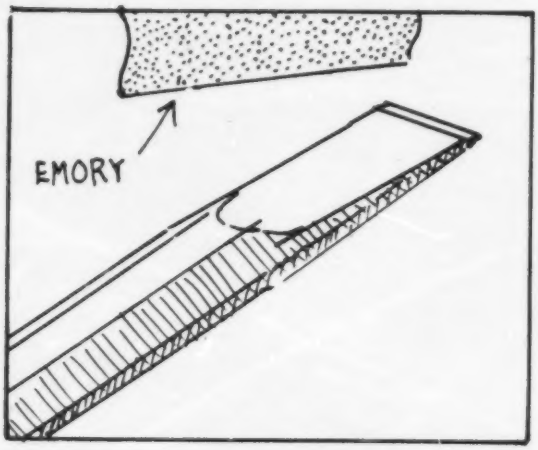
STEP 4 – Repeat step 2 until the tip of the chisel has a sharp point.

Check Point

Ask the instructor to examine the tip of the chisel.

Instructional Objective XIII

Given the proper tools and equipment, each student will temper (heat treating the metal) the tip of the chisel.

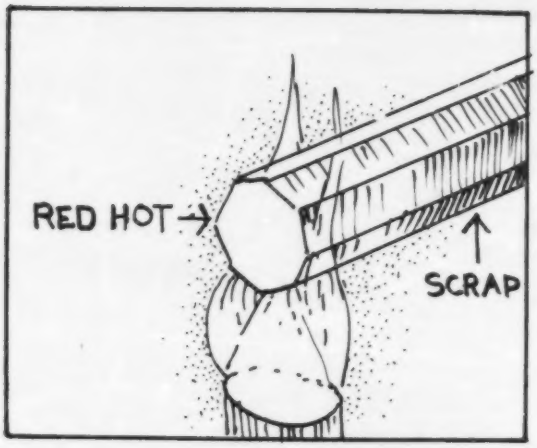


STEP 1 – Polish the forged surface of the chisel with a piece of emory cloth.

STEP 2 – Color is important in tempering. (Tempering will appear in the form of changing colors on a polished surface.) Study the chart below; find the color at which you should temper a chisel.

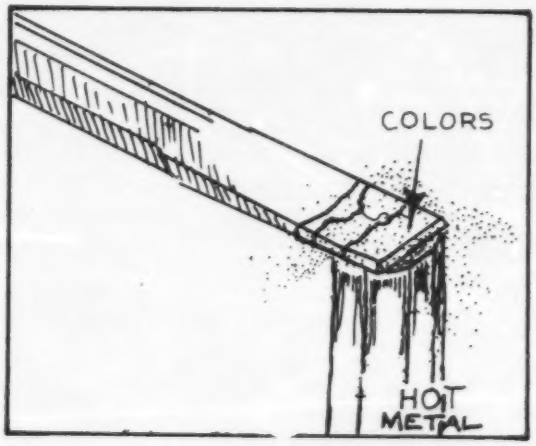
IRON AND STEEL

For Tempering		
°F in Celsius	Color	Kind of Tool
221.1	Yellow	Scrapers, lathe cutting tools, hammers
243.3	Straw	Punches, dies, hacksaw blades, drills, taps, knives, reamers
260	Brown	Axes, wood chisels, drifts
282.2	Purple	Cold chisels, center punches, rivet sets
298.8	Blue	Screwdrivers, springs, gears, picks

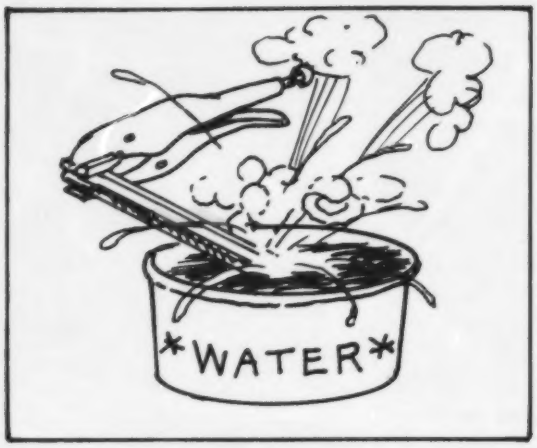


STEP 3 – Heat a scrap piece of metal until it is red hot; then remove it from the heat.

SAFETY NOTE: Wear safety goggles and leather gloves while working with hot metal.



STEP 4 – Place the tip of your chisel on the red hot metal; watch closely as the colors listed in step 2 will appear very quickly and travel toward the handle.



STEP 5 – As soon as the purple color appears, quickly remove the chisel from the hot metal and submerge it in a bucket of water. This process is called quenching. This action of rapid cooling sets the hardness of the metal.

Check Point

Have your instructor inspect the completed cold chisel.

612.131-010 FORGE-SHOP SUPERVISOR (forging) blacksmith supervisor.

Supervises and coordinates activities of workers engaged in heating, forging, and inspecting metal workpieces and products: Plans and coordinates sequence of operations within forge shop. Inspects dies, machines, and work in process to detect malfunctions, and orders corrective action. Trains new workers in job duties. Performs other duties as described under SUPERVISOR (any ind.). May set up machines for experimental runs. May be designated according to department as HAMMER-SHOP SUPERVISOR (forging); INSPECTION SUPERVISOR (forging).

612.261-010 INSPECTOR (forging)

Inspects forgings for conformance to specifications, following blueprints and using measuring instruments, and determines cause of defects by applying knowledge of metal characteristics and forging methods: Verifies dimensions of forgings, using measuring instruments, such as calipers, gages, and rules. Examines forgings to detect surface defects, such as scale, laps, and cracks. Informs supervisor of defects and their probable cause. May stop production and order variations in forging methods, such as change in heating temperature, modification of ram stroke, or realinement of dies to correct defects. May read job order to determine if all specified operations, such as heat-treating, cleaning, and machining have been performed. May straighten warped forgings [STRAIGHTENING-PRESS OPERATOR (any ind.)] May test hardness of forgings [HARDNESS INSPECTOR (heat treat.)]. May inspect metal forgings for internal flaws, using ultrasonic inspection equipment. May inspect raw stock. May inspect hot forgings before completion and be designated INSPECTOR, HOT FORGINGS (forging).

612.360-010 DIE SETTER (forging)

Sets up forging machines, such as forging presses, coining presses, drophammers, forging rolls, and upsetters, following blueprint, work order, and data-chart specifications, and using handtools and measuring instruments, such as rules, squares, and gages: Alines and bolts specified dies to ram and anvil of presses and hammers. Installs impression and gripping dies and synchronizing cams on upsetting machines. Sets and bolts roll dies into self-positioning slots or dogs on roll shafts of forging rolls. Alines and bolts positioning fixtures and stops, and turns handles or knobs to synchronize conveyor speed with forging-machining action and heating cycle of furnace. Starts machine and inspects work to verify conformance of die setup to specifications. May be designated according to machine set up as DROP HAMMER SETTER-UP (forging); FORGING PRESS SETTER-UP (forging); UPSETTER SETTER-UP (forging).

612.361-010 HEAVY FORGER (forging)

Shapes heated metal stock into forgings on power hammer or press equipped with open dies, applying knowledge of forging techniques and physical properties of metal, following work order, diagrams, or specifications, and using measuring instruments and handtools: Alines and bolts dies into ram and anvil of machine, using rule, square, gages, and handtools. Observes color of metal in furnace to determine forging temperature and signals HEATER (forging) to pull metal from furnace. Directs LEVER TENDER (forging) to start machine and regulate action of hammer or press, and directs HEAVY-FORGER HELPER (forging) or MANIPULATOR OPERATOR (forging) to position and turn metal on anvil of machine. Verifies dimensions of forging, using rule and calipers. May forge cold metal. May be designated according to forging equipment as HAMMERSMITH (forging); PRESS SMITH (forging).

619.666-010 FORGE HELPER (forging) press helper; trim-setter helper.

Performs any combination of following tasks to assist workers in forging metal products: Loads bars, billets, or blooms into furnace, using hoist. Transfers workpiece to and from work stations, such as furnace, hammer, and trim press, using tongs or hoist. Removes scale from workpiece and dies, using broom or airhose. Trims excess material from finished parts, using handsaw or bandsaw.

Marks material with specified information, using hammer and die. Lifts dies to machine and bolts dies in place, using hoist and wrenches. Loads racks, offbears conveyors, and cleans and lubricates machines. May work as member of crew. May load radioactive uranium elements into furnace, using hoist. May be designated according to worker assisted as DROP-HAMMER-OPERATOR HELPER (forging); EXTRUDER-OPERATOR HELPER (forging); EXTRUDER-OPERATOR HELPER (forging); HEATER HELPER, FORGE (forging); UPSETTER HELPER (forging); or by task performed as SCALE SHOOTER (forging). Performs other duties as described under HELPER (any ind.).

619.682-022 HEATER (forging) furnace operator; furnace tender; hammer heater; heater, furnace; slug-furnace operator.

Controls oil, gas, or electrical furnace to heat stock, such as billets, bars, plates and rods, preparatory to forging, following work order specifications: Read dials and gages, and turns knobs to regulate flow of fuel or electric current to verify and maintain specified temperature within furnace. Positions stock in furnace, using tongs or chain hoist. Observes color of metal or reads pyrometer to determine when stock reaches forging temperature. Pulls stock from furnace and delivers it to forging press or hammer, using tongs or chain hoist. Usually works as member of hammer, press, or upsetter crew. May place heated workpiece on conveyor for transporting to work area. May turn knobs to synchronize speed of feed and takeoff conveyors of automatic furnace.